NEURO-FUZZY MODELLING OF MACROECONOMIC DETERMINANTS AND INTEGRATION OF STOCK MARKET: A STUDY OF NEW YORK STOCK EXCHANGE AND NATIONAL STOCK EXCHANGE

SYNOPSIS

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INTRODUCTION

"The Stock Market is the story of cycles and of the human behaviour that is responsible for overreactions in both directions."

-Seth Klarman

In an economic system, Stock Market can be said as one of the most versatile Market. It plays crucial part in development of the economy especially in developing countries like India. A very vital element for any economy is stock market. Stock market is backbone of financial sector of an economy which attributes to huge impact on global scale as in current economic world all economies are intertwined and for that macroeconomic Determinants shall be considered and studied in detail.

Though stock market does not have any physical existence as such, still it influences and economy financially upto a great extentand yet it isespecially important. It is akin to the term "Economy" which itself does not comprise of any single physical unit but still holds a great significance on its own as it can be said that it consists of all the significant components existing within the nation that can be tracked worldwide electronically. In spite of that botheconomy and stock market are having very distinct effect on each other.

ABOUT INDIAN AND US STOCK MARKET

A strong nation implies sound financial condition of business within a country itself. This clearly states that economy's financial well-being is upto the mark and well established. In context to the abovesaid, whether the businesses, enterprises and start-up companies are doing well or not can also be a manner of evaluation for the financial status of that particular nation's economy. Countries whose stock markets are on the rise are considered to be emerging economies, while those with established stock markets are rightfully considered strong economies. These perceptions drive a number of economic activities, including foreign investments. Emerging economies, for instance, are promising grounds for both local and foreign investors to put their money.But again, consequences can be devastating and far-reaching when the stock markets of established or emerging economies lose value. Back thenon October 29, 1929 – a day that later came to be known as Black Tuesday – such a day when US stock market prices collapsed. The Great Depression then follow, throwing much of the world into a downward economic spiral that lasted a decade or so. Many economists agree that Black Tuesday contributed greatly to the Great Depression.

Journey of stock market in India started in 1830 (Raju &Paldon, 2019).The largest two Indian Stock Markets are:

1. Bombay Stock Exchange (BSE)
2. National Stock Exchange (NSE)

The modern stock market is significantly much more complicated than its original incarnation. International trade is one of the reasons for global interdependency.It can be highlighted thatthe interconnections and relationships between the National Stock Exchange (NSE) and several prominent stock exchanges worldwide. These findings emphasize the importance of studying and understanding the integration of various stock exchanges. The bi-directional relationship observed between the NSE and the NIKKEI 225 index, as well as the Shanghai Stock Exchange (SSE), suggests a mutual influence where market movements in one exchange impact the other, indicating a high level of integration between these markets. On the other hand, the unidirectional relationship between the NSE and exchanges such as the Australian Stock Exchange (ASX), Euronext, Hong Kong Stock Exchange (SEHK), NASDAQ, Tokyo Stock Exchange (TSE), and Shenzhen Stock Exchange (SZSE) implies that the NSE plays a significant role in influencing these markets, while the impact from these markets on the NSE might be relatively limited (Deo, M. and Prakash, A.P, 2017). Mutual dependency between global stock markets is known as global integration of stock market.

New York Stock Exchange (NYSE)

The origin of NYSE traces back to 1792 when buttonwood agreement was signed on May 17. The organization was initially named New York Stock & Exchange Board. Further delving onto NYSE, it originated as a result of Buttonwood Agreement which was signed on May 17, 1792 in the presence of 24 stockbrokers. Thereafter NYSE started operating as non-profit corporation. It evolved completely as NYSE proximately in 1863.NYSE started working as public trading corporation in the year 2006 and later during 2007 it merged with EURONEXT. It acquired American Stock Exchange in 2008. In row to this NYSE was further bought by “Inter-continental Exchange” for 8.2 billion $.

Continuous auction format is followed usually by the traders of the NYSE. Majority of the stocks are sold on NYSE electronically even then it is famously known for having trading floor. NYSE still has both options available- electronically as well as manually. This implies that NYSE follows hybrid

system for trading stocks that is stock transactions are done physically through brokers on the trading floor of NYSEalongwith option of e-trading available where stocks can be purchased and sold by stock brokers.

National Stock Exchange (NSE)

Year 1992 marks the existence of National Stock exchange which is the largest stock market that is. The NSE has developed into a sophisticated, electronic market, which ranked fourth in the world by equity trading volume and ninth on basis of net worth. Trading commenced in 1994 with the launch of the wholesale debt market and a cash market segment shortly thereafter.

Today, NSE conducts transactions in the wholesale debt, equity, and derivative markets. One of the more popular offerings is the NIFTY 50 Index, which tracks the largest assets in the Indian equity market. US investors can access the index with exchange-traded funds (ETF), such as the iShares India 50 ETF (INDY).

The National Stock Exchange of India Limited was the first exchange in India to provide modern, fully automated electronic trading. It was set up by a group of Indian financial institutions with the goal of bringing greater transparency to the Indian capital market. Cross-border integration is the result of increase in the financial transactions globally without the constraint of geographical borders of a country which increases the extent of trades and services. Also, exchanges have begun to offer cross-border trading to facilitate overseas investment options for investors. Also, exchanges have begun to offer cross-border trading to facilitate overseas investment options for investors which is the main cause of increased volume of the trade that further made it more appealing for investors. Exchanges regularly solicit companies outside their home territory and encourage them to list on their exchange and global competition has put pressure on corporations to seek capital outside their home country. The Indian stock market is the world's third largest stock market on the basis of investor base and has a collective pool of about 20 million investors. There are over 9,000 companies listed on the stock exchanges of the country. The integration of Indian Market with the other worldwide markets reflects the changes on the counterparts.

DYNAMIC SYSTEM MODELLING THROUGH NEURO- FUZZY LOGIC

"Most models fit in one of the three general classes. The first types are models that represent a

particular phenomenon at a point of time, a static model. The second type is comparative static models that compare some phenomenon at different points in time. The third one type are the models that describe and analyse the very processes of a particular phenomenon. These models are known as dynamic models, as they try to reflect changes in real and simulated time and take into account that the model components are constantly evolving as a result of previous actions." (Bhadauriya, 2014)

Neuro-Network and Fuzzy system works on emulating the reasoning abilities of human being. Neuro-Fuzzy Model answers the 'Maybe' and not just the 'Yes' or 'No' unlike other systems i.e. in simple terms when questioned, a human being would answer in either 'Yes' or 'No' or 'Maybe' but a computing device could not move past 'Yes' or 'No'. Fuzzy Logic tries to mind this gap of the grey area which provides the answers for an uncertain and ambiguous 'Maybe' as well. Fuzzy logic clearly defines relationship between two variables based on if-then rules alongwith ambiguous predicates. Whereas pre-requisite for Neural network is based on the coded network within certain parameters. To apply the neuro network, explicit understanding of knowledge-based techniques is not required. Thus, Neuro-Fuzzy is integration of 'Neural Network' and 'Rule-Based Fuzzy logic System' that leads to more accurate results.

REVIEW OF LITERATURE

Review of this study contains time frame of 2022 to 2012. This is because the stock market volatility before the year 2012 is not significant as per the requirement of the study as we can see that stock market was not much volatile. Stock market has shown much more volatile trends after 2012such and that is why reviews after 2012are included here in review of literature.

TABLE 1 NATIONAL REVIEWS

S.No.	Author	Year	Title	Objectives	Findings
1	Mane, O. and Kandasamy, S.	2022	Stock Market Prediction using Natural Language Processing – Survey	To find a way past problems like volatility, seasonality, and dependence on time This paper surveys recent literature in the domain of natural language processing and machine learning	The main contributions of this paper include the sophisticated categorizations of many recent articles and the illustration of the recent trends of research in stock market prediction and its related areas.

				techniques used to predict stock market movements.	
2	Nathani, N. and Kushwah, S.V.	2022	Volatility study in some of the emerging stock markets: a GARCH approach	To analyse the volatility of stock indices of some developing and developed economies regarding the emerging index of India, Nifty. To understand the trends of the volatility of stock indices and the interdependence among the stock markets of these economies.	The result indicates that ARCH and GARCH effect has been seen but the terms are not significant in Tepix, SSE Composite and Nikkei stock indices while significant among Nifty and Nasdaq Composite. The volatility interactions between Nifty and Nasdaq Composite are more prominent as compared to other stock indices considered and investors are suggested to study the movements of Nasdaq Composite before making an investment decision for Nifty.
3	Jana, S.	2021	Stock Market Integration and Trade: A study on India and it's major trading partners	To confirm the result of Johansen cointegration test, the same test was run on joint index for each group and Sensex of India. To check the effect of geographical proximity on this integration.	Trade of India with Asian countries has increased in recent years and integration has also increased. Although time series and pooled panel regression do not prove its significant impact on conditional correlation between India and the sampled countries. But trade between two countries definitely bear a role in integration.
4	Jain, S. and Kahiramka, S. and Jain, P.K.	2021	Determinants of stock market reaction to cross-border acquisitions: Evidence from emerging economies	The paper investigates the announcement impact of CBAs of CNX Nifty 500 Indian and SSE 380 Chinese companies. The event study analysis of 553 Indian and 125 Chinese acquisitions supports the contention that	CBAs generate positive and statistically significant abnormal returns for shareholders of both Indian and Chinese acquirers. The markets, however, differ in terms of their motivations; country-

				CBAs are indeed a strategic choice of EMCs for value creation.	level factors have been observed to exert significant influence on the returns of Indian acquirers. Indian companies experience larger value creation on acquiring firms established in developed, institutionally closer and/or economically distant markets. The findings support the asset-seeking motive of Indian companies.
5	Naik, P. and Reddy, Y.V.	2021	Determinants of stock market liquidity – A Macroeconomics perspective	This study examines the impact of macroeconomic indicators on the liquidity of the Indian stock market by using the Granger Causality, Vector Auto-Regressive Model, and Impulse Response Functions.	The study reveals that the tightness facet of liquidity is primarily affected by the indicators and further concludes that higher foreign investment inflows and gold prices impair the aggregate liquidity. In contrast, a surge in money supply strengthens the stock market liquidity.
6	Agarwal, P.K., Nandan, T. and Singh A.P.	2020	Stock markets integration with special reference to India: A review of literature	The main theme of this study was to provide the available existing comprehensive literature on stock market integration with special reference to India in a summarized form so that investors can quickly access the present integration status of India with existing developing and developed countries.	Global investors could make more rational decisions by studying the strength of interdependencies and interlinkages among stock markets of different countries. In the last few years, investments made by FIIs or foreign investors were of significant quantum in India; so, there is a need to check whether they would be benefited by investing in India.
7	Rajni	2018	An analytical study of movement of stock of Automobile	To predict fluctuation in stock market. It helps to study current trend and	Investors are interested in predicting the future behaviour of stock market. The investor

			industry in national Stock Exchange since 2000	strength selective industry It recapitulates for finding key and give exhibit suggestion to investor.	should look at the price movements of the particular company over the years and should go for better portfolio. The actual status of the organization, information which can affect buying decisions etc. is available in financial results which is very vital for analysis. Speculative or sentimental factors do play a role in price movement of shares. But it is only a short-term effect, long term annual performance is sole factor responsible for price movement.
8	Garg, K. and Karla, R.	2018	Impact of macroeconomic factors on Indian stock market	To measure the relationship between the stock market and selected macroeconomic variables	The result shows that there is a positive relationship between the Sensex and macroeconomic factors except avg. inflation and unemployment rate as they show negative relationship.
9	Kansal, P. and Singh, S.	2018	Determinants of overconfidence bias in Indian stock market	To conduct an exploratory analysis of the demographic factors and investors' characteristics, which cause changes in the extent of overconfidence level and its constituents among the individuals.	The results show that those who earn high, have more dependents, share the earning responsibility, have high investment frequency, less time horizon and more investment experience and invest in large cap stocks are more subject to the overconfidence. The study also concludes that gender, age and general education do not affect the level of overconfidence.
10	Gupta, L. and Srivastava	2018	Testing financial integration between stock	To analyse the scope of financial integration between	Testing results of Granger Causality explained that TSE

	, R.K.		markets of India and Japan: An Empirical study	Indian stock market (NSE) and Japanese stock market (Tokyo Exchange) by taking daily closing index of NSE and TSE. To explore existence of dynamic interlinkages and causal relationship between the Indian Stock Market (NSE) and Japanese stock market (Tokyo Exchange).	Ganger causes return at NSE and NSE also Granger causes return at TSE. We examined Co-integration and found a cointegration relationship between NSE and TSE. Therefore, during the study it was found evidence of financial integration between the market of India and Japan
11	Singh, A.K. and Nainwal, N.	2017	Estimating the Long - Run Determinant of the Efficiency of the stock market in India	To test the AMH for an emerging stock market To capture the time-varying property of market efficiency	Finding shows significant and positive coefficient of the event dummy variable which suggests that the efficiency gap increases with major macroeconomic events or crises. Our results are consistent with the view that dramatic increase in news and rumours magnify a crisis and strategies of traders during a crisis explain the nature of heightened volatility.
12	Deo, M. and Prakash, A.P.	2017	A study on integration of stock markets: Empirical evidence from national Stock Exchange and major global stock markets	To analyse the movements of the Indian Stock Market with special reference to NSE in comparison to the indices of major stock exchanges in the world. To examine the long term and causal relation between NSE and other major stock exchanges in the world	The results of Johansen cointegration test confirmed the long-term relationship between NSE and other indices of major stock exchanges in the world. So it can be concluded that all the chosen indices are cointegrated with NSE Nifty during the study period. The results of Granger causality test have revealed the bi-directional relationship between NSE and NIKKIE 225, SHANGHAI,

					Similarly, it delineated a unidirectional relationship between NSE and, AUSTRALIA, DEUTSCHE, EURONXT, HANG SANG, NASDAQ, NYSE and SHENZEN
13	Bhargava A. and Bhargava, A.	2016	Affecting stock prices in India: A time series Analysis	To study the relationship between different factors determining the stock prices in Indian Stock market. A time series regression with independent variables as Inflation, Index of Industrial production (IIP), Money Supply, Oil prices, Exchange rates, Gold prices and Gross domestic product (GDP) and stock prices as dependent variable is run in order to validate if these variables are statistically significant in explaining the behaviour of stock prices in Indian market or not	It established that Exchange Rate, Oil Prices and WPI do have an effect over stock prices in India. Another interesting result that we observe is that gold price does not have any significant impact over the stock prices. Similar results have been found out in other literatures too. Finally, we reject the null hypothesis of all variables do not affect stock prices and can accept the alternate hypothesis i.e., there are some variables present in the model that do affect the stock prices in India.
14	Sagar, S.	2015	A study of impact of selected factors on currency derivative transactions	To study the Impact of Crude oil prices on Currency Derivative Transaction To study the Impact of Currency rate (Dollar) on Currency Derivative Transaction To examine the relationship between BSE Sensex and Currency Derivative Transaction To study the impact	The study examined the impact of selected factors (Crude Oil Prices, Currency Rate & BSE Sensex) on Currency Derivative Transactions. Various statistical tools and methods have been used to address the research aim, and hypotheses of the study, Linear Regression & Correlation, Multiple Regressions & Correlation, Unit Root Test and

				of selected factors on Currency Derivative Transaction	Granger Causality Test.
15	Bhadauriya, S.	2014	Dynamic system modelling of micro economic determinants of stock market volatility via fuzzy -neuro networks: Evidence from national stock exchange of India limited	To identify the macroeconomic variables affecting stock market volatility. To predict stock market behaviour effected due to macroeconomic variables by developing a model, using GARCH. To develop System Dynamics Model for predicting the impact of macroeconomic variables on the behaviour of stock market. To develop a Neuro-fuzzy Rule Based Model for predicting the impact of macroeconomic variables on the behaviour of stock market. To compare the results of GARCH Model, System Dynamic Model and Neuro fuzzy based model with a view to examine the reliability of these models.	The researcher hypothesized that modelling via System Dynamics Technique and Fuzzy-Neural Networks are better predictor of Stock Market Volatility than the Multivariate GARCH Model. The research assumption proved correct as Fuzzy Neural Networks based models are better predictor of stock market volatility than the System Dynamic Models, and System Dynamic Models are better predictor of stock market volatility than the Multivariate GARCH models
16	Singh, A.	2013	Impact of financial factors on stock market: Empirical evidences from India US and UK	To examine the stock markets of India, U.S. and U.K. with regard to State influence. To identify and analyse the financial factors in selected stock markets. To investigate the relationship among India, U.S. and U.K. stock markets on financial factors. To analyse the impact of financial factors on selected stock markets.	The study reveals long run relationship among the variables and the results of Granger Causality test reveals unidirectional, bilateral relation (Feedback) and exogeneity (Independence) among the variables.

				To recommend an action plan for sound investment decisions in international scenario.	
17	Malhotra, N. and Tandon, K.	2013	Determinants of a stock prices: Empirical evidence from NSE 100 companies	The present study has been undertaken with an objective to review the existing literature by examining the empirical relationship between stock prices and company specific intrinsic factors such as book value per share, dividend per share, earning per share, price earnings ratio, dividend yield, dividend pay-out, size in terms of sale and net worth IRACST-International Journal of Research in Management & Technology (IJRMT), ISSN: 2249-9563 Vol. 3, No.3,June 2013 87 for NSE 100 companies during the period 2007-08 to 2011-12.	The findings of the study for the period 2007-12 revealed that firms' book value, earning per share and price-earnings ratio are having a significant positive association with firm's stock price while dividend yield is having a significant inverse association with the market price of the firm's stock. Together these four variables explain 51.6% of the dependent variable.

TABLE 2 INTERNATIONAL REVIEWS

S.No.	Author	Year	Title	Objectives	Findings
1	Chimprang, N. and Tansuchat, R.	2022	An Application of Quantum optimization with Fuzzy Inference System for Stock Index Futures Forecasting	To ensure the potential gain in futures market trading. To obtain in the financial data which normally have high fluctuation	The result reveals that the hybrid WT-QPSO-ANFIS model provides higher efficiency and accuracy in predicting all 11 stock index futures considered in this study compared to the conventional Sugeno-type ANFIS model, ANN model and ARIMA model in terms of Root Mean Square Error (RMSE), Mean Absolute Error (MAE), Mean Absolute Percentage

					Error (MAPE), and Standard Error of Mean (SEM).
2	Rahbar, M.A.	2022	Method of genetic algorithm and adaptive neural-fuzzy network (ANFIS) model in predicting the bankruptcy of companies listed on the Tehran Stock exchange	To check the phenomenon of bankruptcy and its prediction. There is presented a hybrid method of Genetic Algorithm (GA) and Adaptive Neural-Fuzzy Network (ANFIS) model to evaluate predicting the bankruptcy of companies listed on the Tehran Stock Exchange.	The results also show that the CM-GA-ANFIS model is known as the best model for predicting bankruptcy of companies listed on the Tehran Stock Exchange. The main reason for choosing the model (GA-ANFIS) is that in addition to the fact that for the first time a combination of two methods ANFIS and GA is used to predict the bankruptcy of companies, and also in none of the studies conducted in both areas which further highlights the need for the present study.
3	Kuvshinov, D. and Zimmerman, K.	2022	The big bang: Stock Market capitalisation in the long run	To study long-run trends in listed firms' market capitalization and their drivers. To introduce a new integrated database covering stock market capitalization, equity issuance, stock prices, and listed firms' dividends and earnings.	This paper introduced a new dataset of stock market capitalization and its drivers—issuances, prices, dividends, profits and discount rates—covering 17 advanced economies between 1870 and 2016. A high-level investigation of the data reveals two broad eras of stock market growth: the period before the 1980s, during which the stock market grew at the same long-run rate as GDP and this growth was driven by equity issuance; and the period after the 1980s, during which capitalization growth accelerated far beyond that in GDP

4	Atmaz, A. and Basak, S.	2022	Stock Market and No-Dividend Stocks	To develop a stationary model of the aggregate stock market featuring both dividend paying and no-dividend stocks within parsimonious consumption-based equilibrium framework.	The presence of no-dividend stocks in the stock market leads to a lower correlation between stock market returns and the consumption growth rate, a nonmonotonic and even negative relation between the stock market risk premium and its volatility, and a downward-sloping term structure of equity risk premium. In terms of new testable predictions for aggregate stock market returns, these findings imply that: the higher the relative market capitalization of no-dividend stocks in the stock market.
5	Demir, C.	2019	Macroeconomic Determinants of Stock market fluctuations: The case of BIST-100	To analyse the impacts of some prominent macroeconomic factors on the Turkish Stock Market index, BIST-100 (Borsa Istanbul-100). For centuries, and mostly since the 20th century, stock markets are at the heart of economies. In our era, the largest economic crises arise from the stock market instabilities and thus, the stock markets are the focus of interest of the economy	The findings obtained from the quarterly data via the ARDL Bounds Test suggest that economic growth, the relative value of the domestic currency, portfolio investments and foreign direct investments raise the stock market index while interest rate and crude oil prices negatively affect it. The results briefly reveal that the Istanbul Stock Exchange Market needs stronger domestic currency, higher international capital inflows, and lower energy and investment costs.
6	Joyo, A. S. and Lefen, L.	2019	Stock Market Integration of Pakistan with Its Trading Partners: A Multivariate DCC-GARCH	To analyse the co-movements and the portfolio diversification between the stock markets of Pakistan and its top trading partners,	Researcher concluded that stock markets of Pakistan and its trading partners were closely integrated during the financial crisis of 2008, while

			Model Approach	namely China, Indonesia, Malaysia, the United Kingdom, and the United States.	the integration among stock markets decreased substantially after the period of financial crises. Furthermore, the results showed the slow decay process.
7	Pavto, S., Velip, and Raju, A.G.	2019	Stock Market Integration: A Review of Literature from a Global Perspective	1) Examine and judge the extent of global stock markets' integration through various literature reviews. 2) Provide the full basket of works on stock markets' integration for quick reference to various researchers and other market practitioners; and 3) Outline the scope of future research in the field of stock markets' integration.	Researcher observed it has been observed that the stock market integration has been accelerated over a period of time, especially after the two major crises, viz., Asian financial crisis of 1999 and 2008 subprime global financial crisis. Further, from the previous studies it is noted that researchers concentrated mainly on the integration between developed and emerging stock markets, while frontier and standalone markets received less focus.
8	Ho, S.Y.	2018	Macroeconomic determinant of a stock market development in South Africa	The purpose of this paper is to examine the macroeconomic determinants of stock market development in South Africa during the period 1975–2015. Specifically, it examines the impact of banking sector development, economic growth, inflation rate, real interest rate and trade openness on the development of the South African stock market	This paper confirms the findings by other studies that banking sector development and economic growth promote stock market development, while inflation rate and real interest rate inhibit stock market development. In addition, this paper finds an interesting result in the fact that trade openness has a negative impact on stock market development, which is different from the findings of many other studies.
9	Aamir, M. and Shah,	2018	Determinants of Stock market Co-Movements	This study analyses the determinants of stock market co-movement	Results of this study reveal that there is long-term integration

	S.Z.A.		between Pakistan and Asian Emerging Economies	between Pakistan and Asian emerging economies for the period 2001 to 2015. Augmented Dickey and Fuller (ADF) and Philips-Perron (PP) tests are applied to check co-integration between their stock markets.	between the stock market of Pakistan and the stock markets of China, India, Indonesia, Korea, Malaysia and Thailand. This study reports the driving forces of the co-movement between the Pakistan and Asian emerging markets where co-integration is found. Results of the panel data reveal that there are significant underlying forces of integration between Pakistan and each Asian emerging stock market. The findings of this study have significant implications for policy makers in Pakistan who are designing strategies for macroeconomic harmonization and stability of the country's economy against financial shocks.
10	Kilic, M. and Watcher, J.A.	2018	Risk, Unemployment, and the Stock Market: A Rare-Event-Based Explanation of Labor Market Volatility	To examine and analyse the use of DMP mechanism to explain the cyclical behavior of unemployment. To identify the matching friction in the labor market and time-varying disaster risk resulting in equity premium and stock return volatility.	The model provides a mechanism through which job creation incentives of firms and stock market valuations are tightly linked, as the co-movement of labor market tightness and stock market valuations Because the labor market and the stock market are driven by the same force, the price of the aggregate stock market and labor market tightness are highly correlated
11	Ho, S.Y. and Iyke, B.N.	2017	Determinants of stock market development	This paper aims to provide a comprehensive review	The theory and the empirics predict different ways in

			review the literature	of the literature on the determinants of stock market development.	which macroeconomic factors affect stock market development. The real income and its growth rate foster stock market development, while the banking sector, interest rate and private capital flows can foster or inhibit it. Inflation and exchange rates have adverse effects on stock market development. In terms of the institutional factors, the literature indicates that different legal origins and stock market integration can have a positive or negative impact on stock market development. In addition, factors such as legal protection of investors, corporate governance, financial liberalisation, and trade openness contribute positively to the development of the stock market.
12	Alam, S. and Miah, M.R.	2016	Analysis on factors that affect stock prices: A study on listed cement companies at Dhaka stock exchange	The prime objective of this study is to examine the determinants that affect stock prices in Dhaka Stock Exchange. The objective of this study is to determine the impact of fundamental factors (EPS, NAVPS, and P/E) on market prices and the impact of technical factors (GDP, CPI & IRS) on market prices.	A moderate R square (0.1142-.4567) found in both the Fixed and Random models justify the considerable impact of these variables on the market price of shares. Hence, the study recommends present and potential investors to consider these factors prior to trade and inject funds on securities as the study witnessed volatility in share prices by the fluctuations of these factors.
13	Dorodnykh, E.	2014	Determinants of Stock Exchange	This paper contains an empirical analysis of	The paper confirms empirically the set of

			integration: evidence in worldwide perspective	determinants of international integration projects over the time period 1995-2010. After a broad discussion of the existent literature, the investigation combines a large number of potentially relevant determinants for the explanation of whether stock exchanges are participating in formal integration projects. The paper aims to discuss these issues.	drivers of financial integration. Moreover, the paper provides quantitative estimations of probability of stock exchange integration estimated for different explanatory variables. The paper demonstrates that financial harmonization, cross-membership-agreements, for-profit corporate structure, trading engine and regional integration are important drivers of stock exchange integration. By contrast, high size of stock exchange market has negative impact on the likelihood of successful merger.
14	Talla, J.T.	2013	Impact of macroeconomic variables on the stock market prices of the Stockholm Stock Exchange (OMXS30)	The key objective of the present study is to investigate the impact of changes in selected macroeconomic variables on stock prices of the Stockholm Stock Exchange (OMXS30). To estimate the relationship, unit root test, Multivariate Regression Model computed on Standard Ordinary Linear Square (OLS) method and Granger causality test have been used.	In addition, interest rate is negatively related to stock price change, but it is not significant in the model. On the other hand, money supply is positively associated to stock prices although not significant. No unidirectional Granger Causality is found between stock prices and all the predictor variables under study except one unidirectional causal relation from stock prices to inflation.
15	Harper, A.H. and Jin, Z.	2012	Do these stock markets move together? An empirical study of India and its major trading partners	This paper investigates the relationships between the monthly returns of the Indian stock returns, and of some of India's major trading partners. By	The results of our study may provide some insights to investors of Indian stock market who seek to reduce their risk exposure by

				using a multivariate co-integration model, we find that the monthly returns of these markets tend to converge in the long run even though they may move in different directions in the short term.	diversifying in these markets.

RESEARCH GAP

Several studies are present which document the impact of various financialand macroeconomic determinants of stock marketbut there is dearth of studies which focuses on Dynamic System Modelling such as Neuro Fuzzy Model with respect to stock market. Various studies have been done on stock market using various Static Models such as GARCH model but Dynamic System Modelling such as neuro-fuzzy model has not been given much importance in India. Previous studies are evident that results obtained by neuro-fuzzy model are more accurate in comparison with GARCH model. Also, this study includes integration of two stock marketsto check extent of accuracy and validity of this model in both national and international market. The present study aims to fill this gap through the Neuro- fuzzy Model as the stock market is most dynamic and versatile market.

NEED OF THE STUDY

Cross-border integration is the result of increase in the financial transactions globally without the constraint of geographical borders of a country which increases the extent of trades and services. Also, exchanges have begun to offer cross-border trading to facilitate overseas investment options for investors which the main cause of increased volume of the trade that further made it more appealing for investors. Exchanges regularly solicit companies outside their home territory and encourage them to list on their exchange and global competition has put pressure on corporations to seek capital outside their home country.There are many factors which affect the stock marketbehaviour rapidly. The variation due to the different factors reflects its impact in the economy also. It is said that if one wants to learn the economic structure of the country, he should read out the behaviour of the stock markets. We will also cover the integration of US Stock Exchange (NYSE) with the Indian Stock Exchange (NSE). Presently, the fluctuations in the Indian Market are attributed heavily to cross border

capital flows in the form of FDI, FII with the reaction of Indian Market to global Market cues. In this context, understanding the relationship and influence of various stock exchanges on each other is very important. This study takes into consideration two different stock exchanges which are from two different geopolitical-socio-economic areasi.e. US and Indian stock markets. With cross-border movements of capital like never before in the form of FDI and FII, coupled with the easing of restrictions bringing several stock exchanges at par in terms of system and regulations, it can be assumed reasonably that a particular stock exchange will have some impact on one or the other exchanges as well. Besides these, we are also going to cover the inter relationships of selected stock exchanges such asNew York Stock Exchange of US and the National Stock exchange of India and other global issues which can affect the whole capital market and its workings also.

In this study researcher will try to find out the impact of various issues on the US and Indian stock markets. The political issues, earning announcements, government policies are the barometers which can affect the market.

OBJECTIVES

1. To identify and analyse the Macroeconomic determinants affecting Stock Market IndicesatNYSE and NSE.
2. To develop the Neuro FuzzyModel for studying the impact of MacroeconomicDeterminants on Market Indices at NYSE and NSE.
3. To analyse the impact of Macroeconomic Determinants on Market Indices at NYSE and NSE through Neuro-fuzzy Model.
4. To examine the integration of Selected Stock Exchanges on the basis of identified Macroeconomic Determinants.

HYPOTHESES

$H_0$1: There is no significant impact of macroeconomic factors on NYSE.

$H_0$2: There is no significant impact of macroeconomic factors on NSE.

$H_0$3: There is no significant relationship between NYSE and NSE on basis of macroeconomic factors.

$H_0$4: There is no significant impact of NYSE on NYSE.

$H_0$5: There is no significant impact of NSE on NYSE.

During the study additional hypotheses may be developed and tested.

RESEARCH METHODOLOGY

To accomplish the purpose of this study, the following researchmethodology is proposed:

- **Scope of the Study:**

  Two Stock exchanges will be considered for the purpose of the study:New York Stock Exchange (NYSE) of US and National Stock exchange (NSE) of India.

- **Type of Data:**

  Secondary data will be used for achieving different objectives of the study.

- **Sources of Data:**

  Data will be collected from various websites (www.niftyindices.com, www.nseindia.com, www.nyse.com/index, www.statista.com, www.rbi.org.in/, scholar.google.com/ etc.), reports and research published in national and international journals, business magazines,periodicals,and newspapers etc. and other relevant sources. Benchmark indices of selected stock exchanges will be considered for the study. The daily and monthly values of Indices will be collected from the websites of the selected stock exchanges.

- **Sample Size:**

  To achieve the proposed objectives, New York Stock Exchange (NYSE) from U.S.Stock Marketwill be taken and S&P 500 index price will be usedas the representative index andNational Stock Exchange (NSE) of India and the CNX Nifty 50 Index as the representative index for Indian Stock Market will be taken into consideration.The selection of the S&P 500 or the New York Stock Exchange (NYSE) is based on market capitalization-based float-weighted index. It tracks the performance of 500 of the largest companies listed on US stock exchanges, providing a comprehensive representation of the US market.Similarly, the CNX Nifty 50 Index is a suitable choice for the National Stock Exchange (NSE). This benchmark index tracks the performance of the 50 largest stocks traded on the NSE and is calculated on a real-time daily basis. The index utilizes a free-float market capitalization method, and covers 23 sectors of the Indian economy.

- **Selection Criteria:**

  On the basis of Market Capitalisation of Listed Companies as of July 2022, among the Top 10

Stock exchanges:

NYSE, United States: US$24.68T (1st Position) and NSE, India US$3.32T (8th Position). NYSE, US stock exchange is the largest stock exchange in the world on the basis of Market Capitalisationi.e.US$24.68T for NYSE and thus being the largest stock exchange NYSE impacts NSE and moreover recent trends has shown that NSE impacts NYSE as well and this will be taken in consideration for the purpose of study.Given the United States' status as the world's largest economy, any imbalances within its stock market have far-reaching consequences for global stock markets, particularly the Indian stock market. Factors such as Federal Reserve rate hikes, COVID-19 impacts, fluctuations in crude oil prices, presidential elections, China-US trade disputes, inflation, dollar-rupee exchange rates, and the global financial crisis of 2007 highlight the notable influence exerted by the US stock market on its Indian counterparts. In contrast, other stock markets, despite their comparable size, lack the same level of significant impact on the Indian stock market as the US stock market does. Therefore, the integration study focuses on the New York Stock Exchange (NYSE) and the National Stock Exchange of India (NSE) due to their relevance and the demonstrable influence of the US stock market on the Indian market.

- **Duration of the study:**

  Researcher will consider 10 Financial Years from 2015-16 to 2024-25.

- **Statistical Tools:**

  For data analysis, researcher will use various statistical tools like mainly Neuro- Fuzzy Model, Average, Standard Deviation, Correlation, Regression, Unit Root Test, Granger Causality Test, JohansenCo-integration Test etc. Selection of tool will be based on nature of data and later other tools will be used.

- **Presentation Tools:**

  For presentation of data- graphs, tables etc. will be used for better understanding.

TABLE 3 OBJECTIVE WISE RESEARCH METHODOLOGY

S.No.	OBJECTIVE	METHODOLOGY
1.	To identify and analyse the Macroeconomic determinants affecting Stock Market Indices at NYSE and NSE.	Available literature will be used to identify various Macroeconomic Determinants which affects the MarketIndices of NYSE and NSE significantly.Some of such determinants are- GDP,

		Inflation,FDI, FII, WPI, IIP, FOREX Reserves,Gold Prices etc. and more will be identified during the course of study. Factor Analysis will also be used for this objective.
2.	To develop the Neuro Fuzzy Model for studying the impact of Macroeconomic Determinants on Market Indices at NYSE and NSE.	The Model will be developed based on the Macroeconomic factors identified in First objective.
3.	To analyse the impact of Macroeconomic Determinants on Market Indices at NYSE and NSE through Neuro-fuzzy Model.	Impact of Macroeconomic Determinants on the Market indices will be analysed through Neuro Fuzzy Rule Based Model.
4.	To examine the integration of Selected Stock Exchanges on the basis ofidentified Macroeconomic Determinants.	Integration of NYSE and NSE will be examined through various tools such as- Unit-Root Test, Granger Causality Test, Johansen Co-Integration Test. Later other tools will be added and used during the study.

PROPOSED CHAPTER PLAN

Chapter 1: Introduction

Chapter 2: Review of Literature

Chapter 3:Macroeconomic Determinants of NYSE and NSE

Chapter 4: Neuro-Fuzzy Modeling of Macroeconomic Determinants of Stock Market Volatility for NYSE and NSE.

Chapter 5:NYSE and Integration with NSE

Findings & Conclusion

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